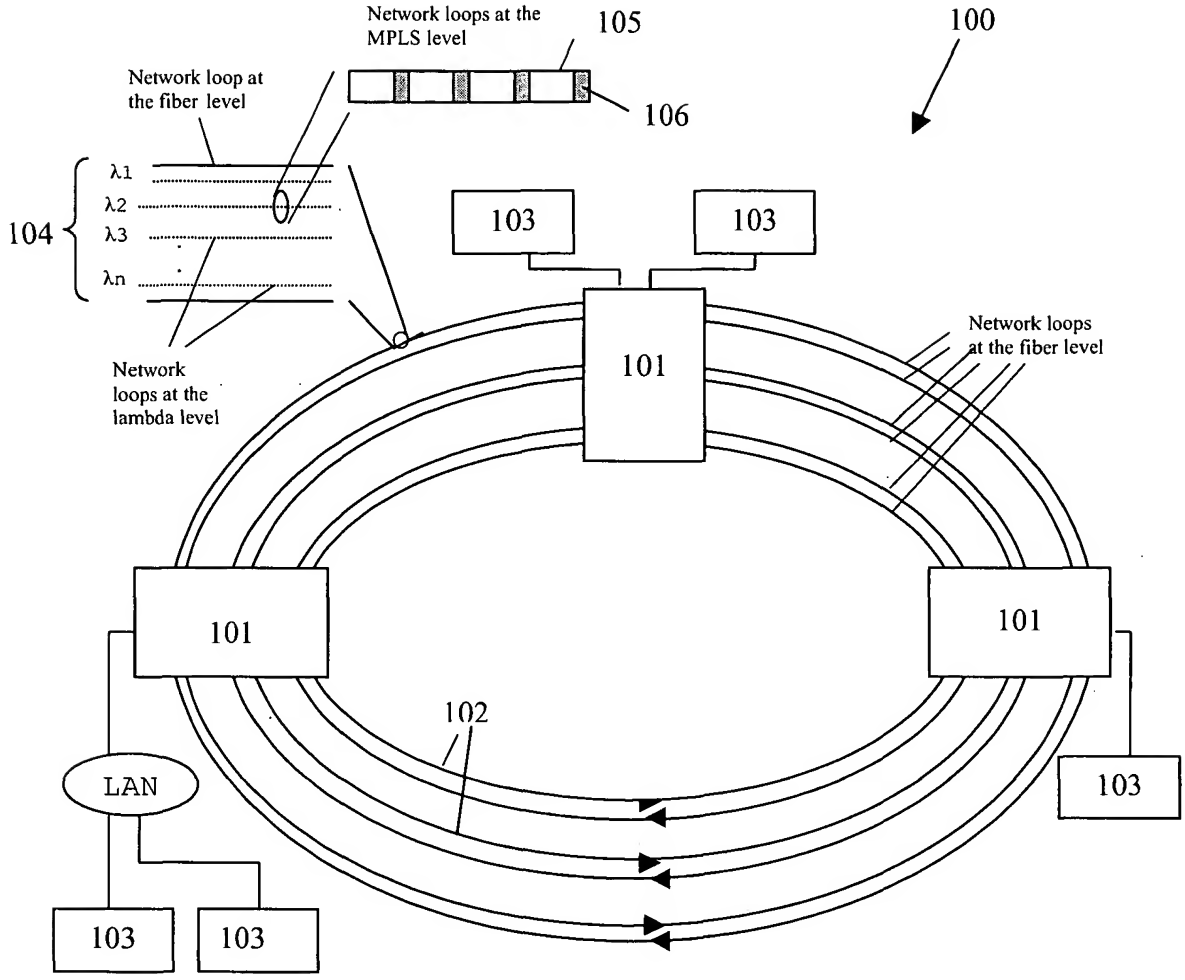

Network loops at the MPLS level
105
100
Network loop at the fiber level
106
λ1
λ2
λ3
λn
104
103
103
101
Network loops at the fiber level
Network loops at the lambda level
101
101
102
LAN
103
103
103

FIG 1

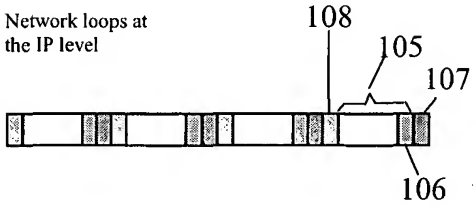

Network loops at the IP level
108
105
107
106

FIG 2

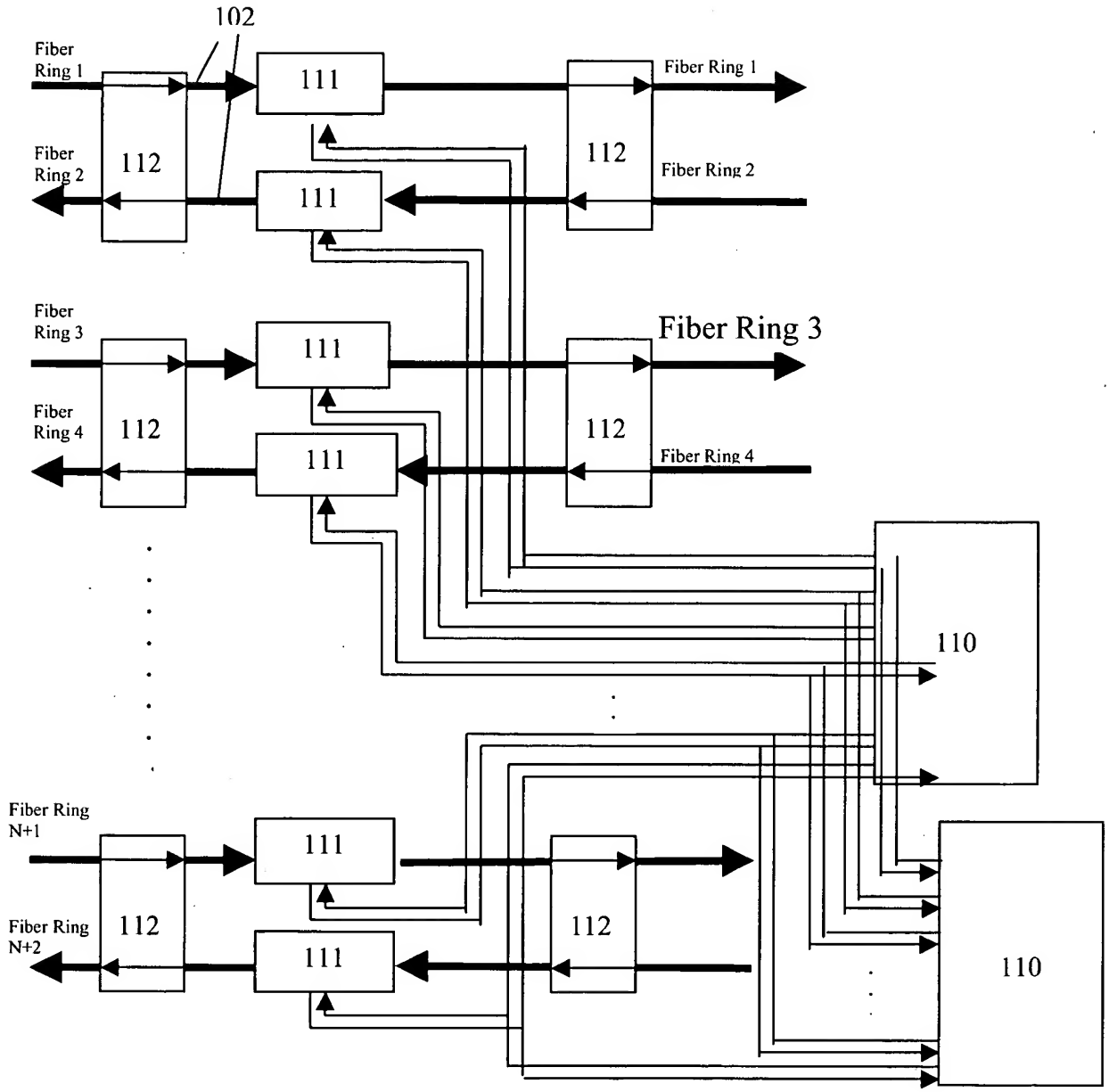

102
Fiber Ring 1
Fiber Ring 2
111
112
Fiber Ring 1
Fiber Ring 2
Fiber Ring 3
Fiber Ring 4
Fiber Ring 3
Fiber Ring 4
110
Fiber Ring N+1
Fiber Ring N+2
Fiber Ring N+1
Fiber Ring N+2
110

FIG 3

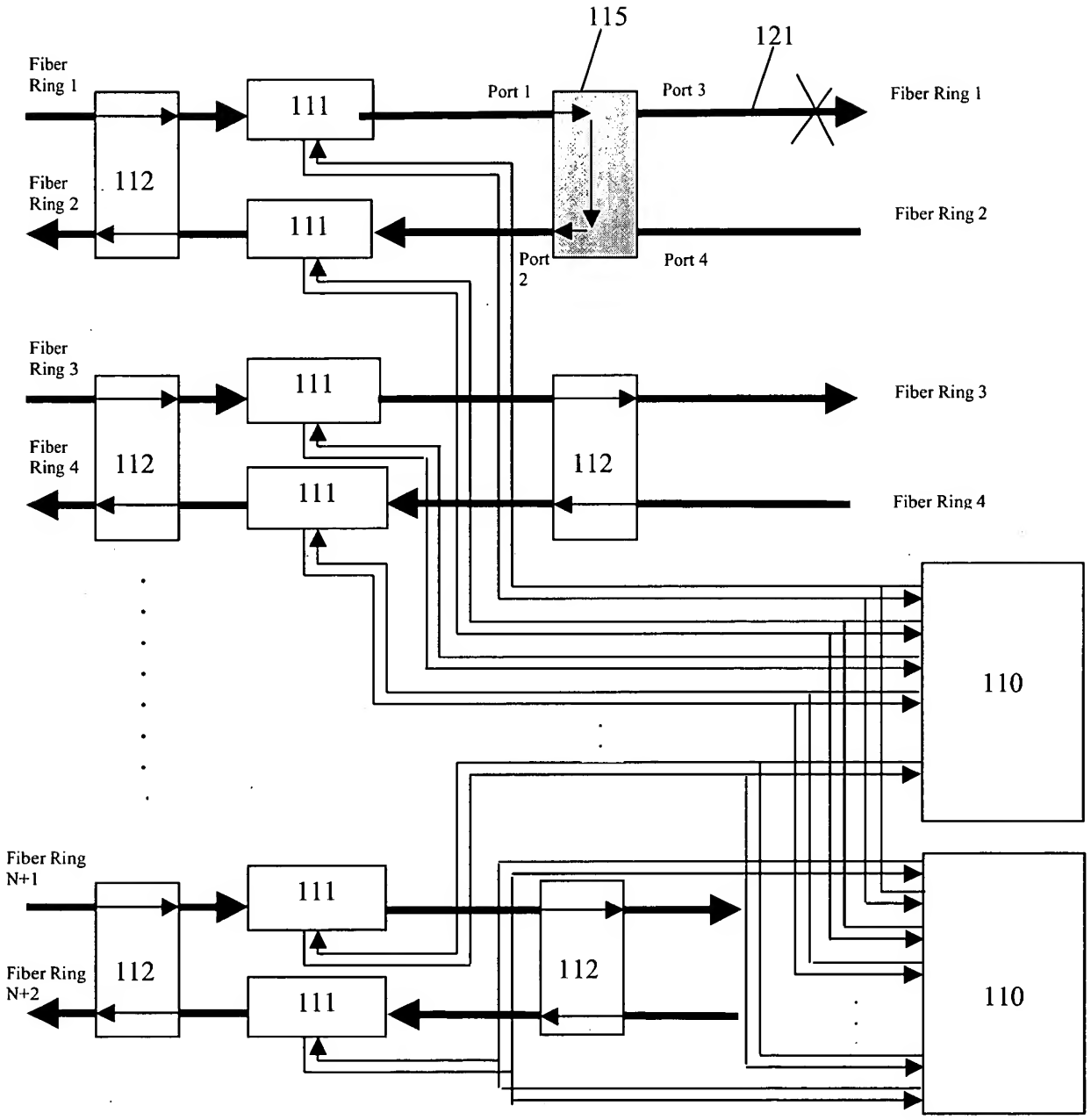

115
121
Fiber Ring 1
111
Port 1
Port 3
Fiber Ring 1
Fiber Ring 2
112
111
Fiber Ring 2
Port 2
Port 4
Fiber Ring 3
111
Fiber Ring 3
Fiber Ring 4
112
112
111
Fiber Ring 4
110
Fiber Ring N+1
111
Fiber Ring N+2
112
112
111
110

FIG 4

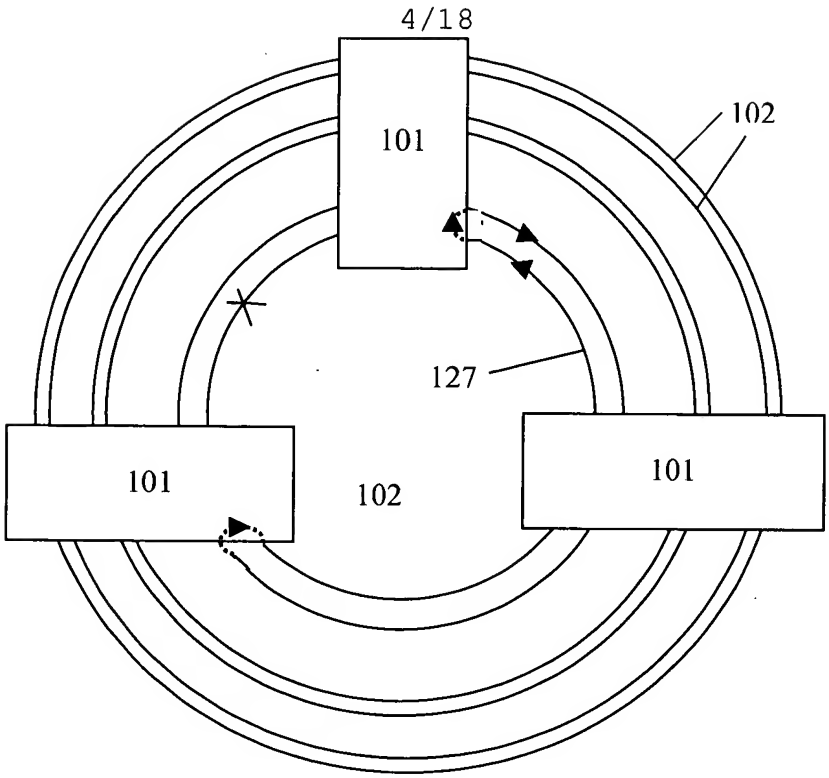
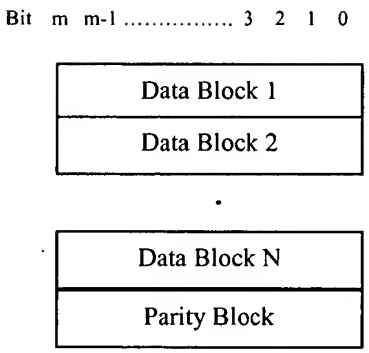


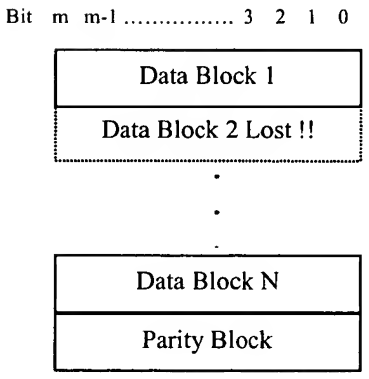
FIG 5



Bit 0 of Parity Block = Bit 0 of Data Block 1 XOR
Bit 0 of Data Block 2 XOR
.
.
Bit 0 of Data Block N XOR

Bit m of Parity Block = Bit m of Data Block 1 XOR
Bit m of Data Block 2 XOR
.
.
Bit m of Data Block N XOR

FIG 6



Bit 0 of Data Block 2 = Bit 0 of Data Block 1 XOR
Bit 0 of Data Block 3 XOR
.
.
Bit 0 of Data Block N XOR

Bit m of Data Block 2 = Bit m of Data Block 1 XOR
Bit m of Data Block 3 XOR
.
.
Bit m of Data Block N XOR

FIG 7

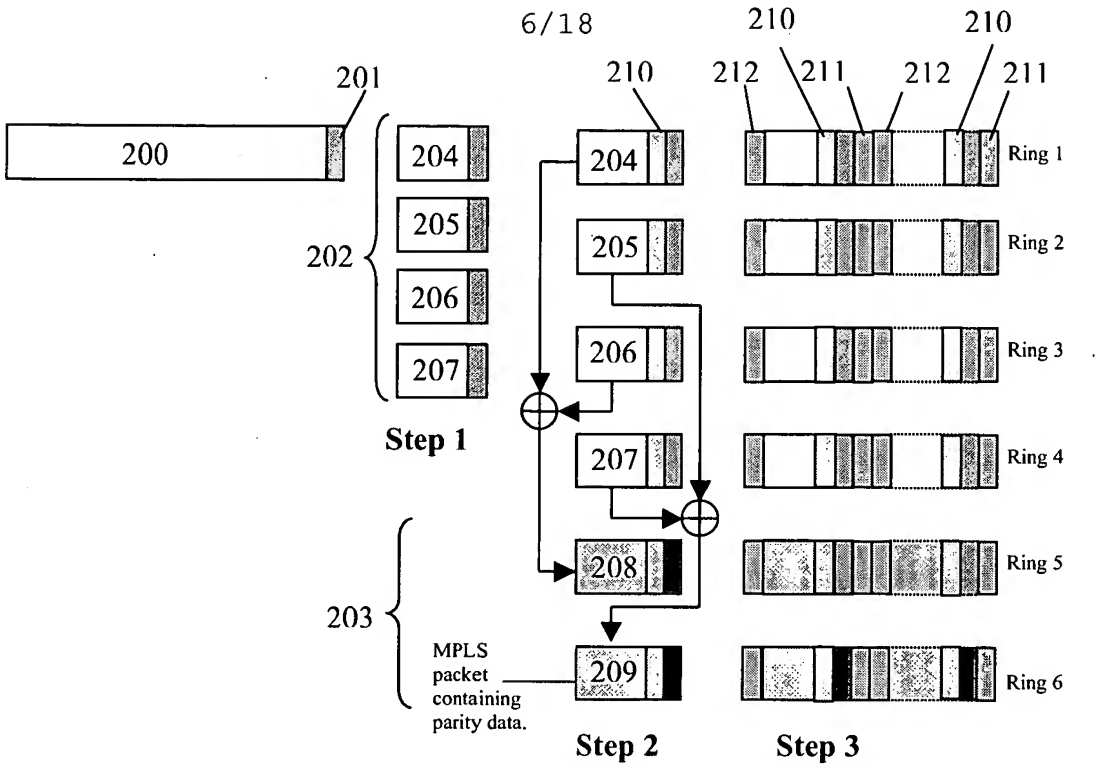

200
201
202
204
205
206
207
Step 1
203
MPLS packet containing parity data.
208
209
Step 2
210
212
211
212
210
211
Ring 1
Ring 2
Ring 3
Ring 4
Ring 5
Ring 6
Step 3

FIG 8

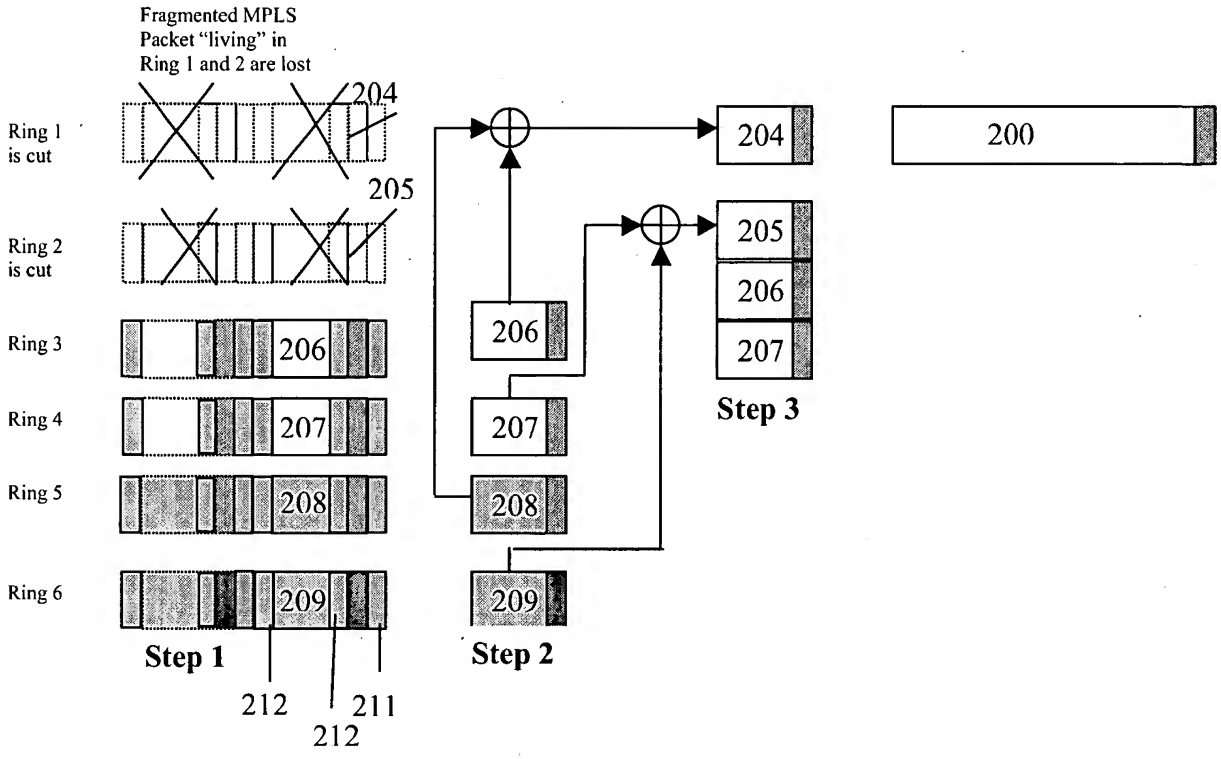

Fragmented MPLS
Packet "living" in
Ring 1 and 2 are lost
Ring 1
is cut
Ring 2
is cut
Ring 3
Ring 4
Ring 5
Ring 6
204
205
206
207
208
209
Step 1
212
212
211
Step 2
Step 3
200

FIG 9

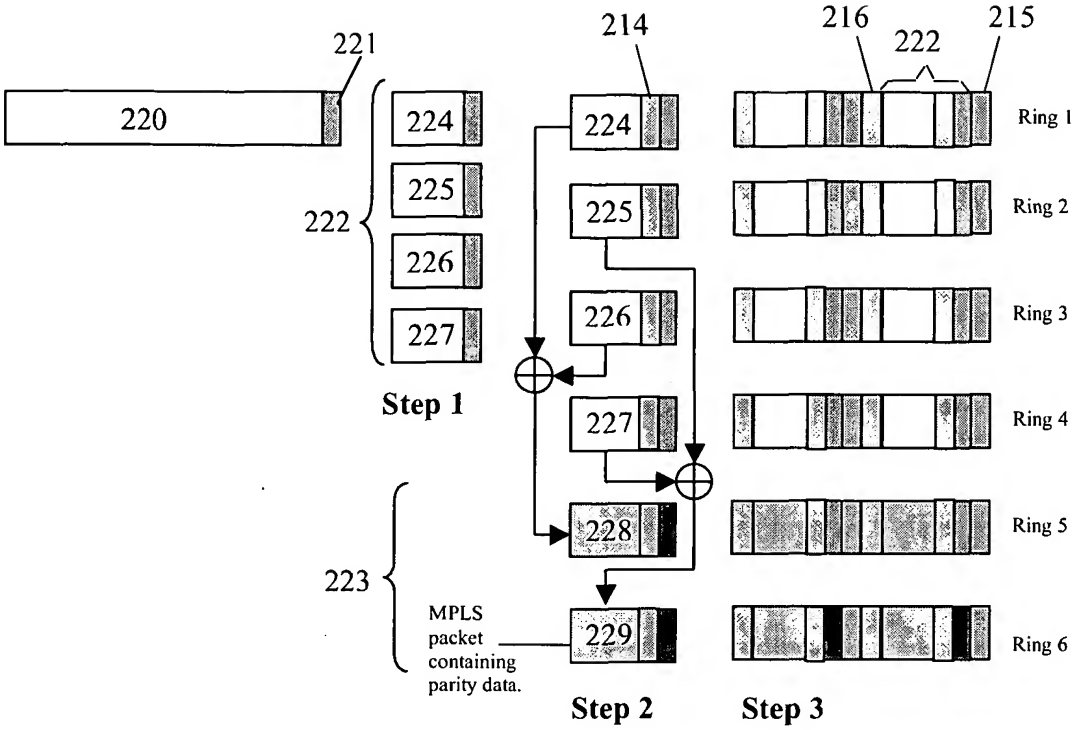

221
220
224
225
222
226
227
Step 1
214
224
225
226
227
228
223
MPLS packet containing parity data.
229
Step 2
216
222
215
Ring 1
Ring 2
Ring 3
Ring 4
Ring 5
Ring 6
Step 3

FIG 10

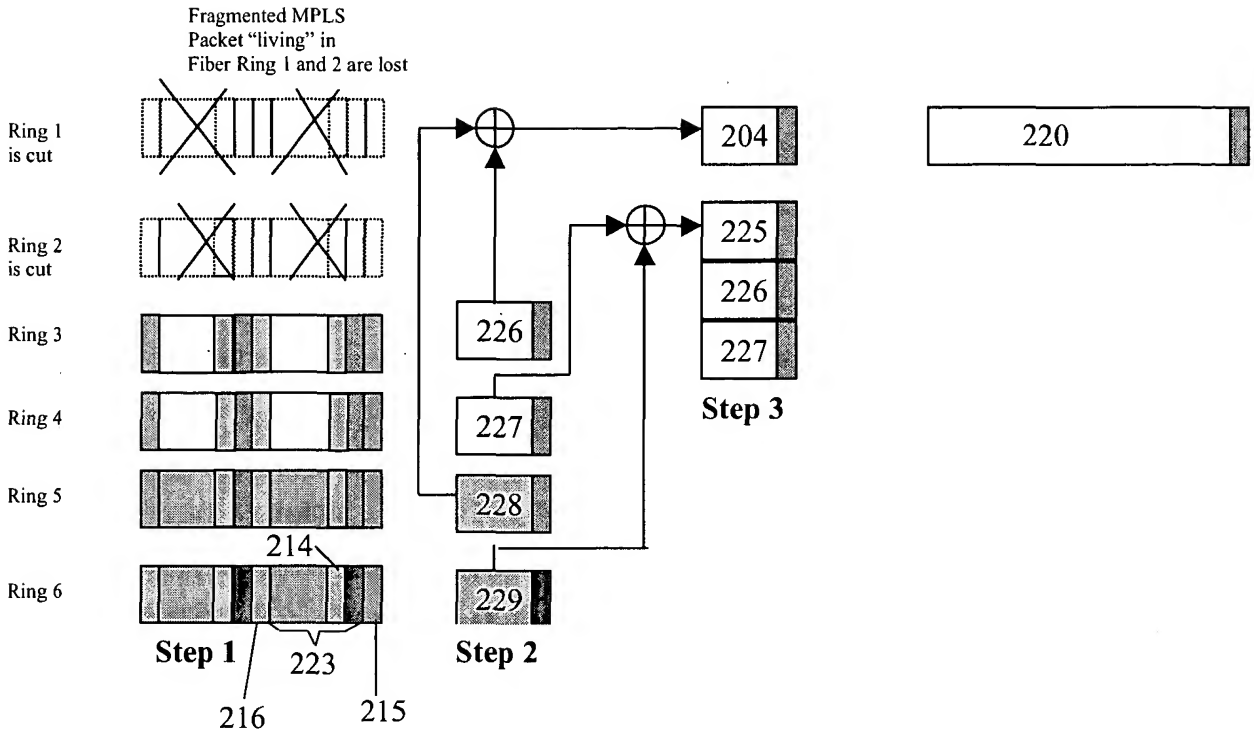

Fragmented MPLS
Packet "living" in
Fiber Ring 1 and 2 are lost
Ring 1
is cut
Ring 2
is cut
Ring 3
Ring 4
Ring 5
Ring 6
214
Step 1
223
216
215
226
227
228
229
Step 2
204
225
226
227
Step 3
220

FIG 11

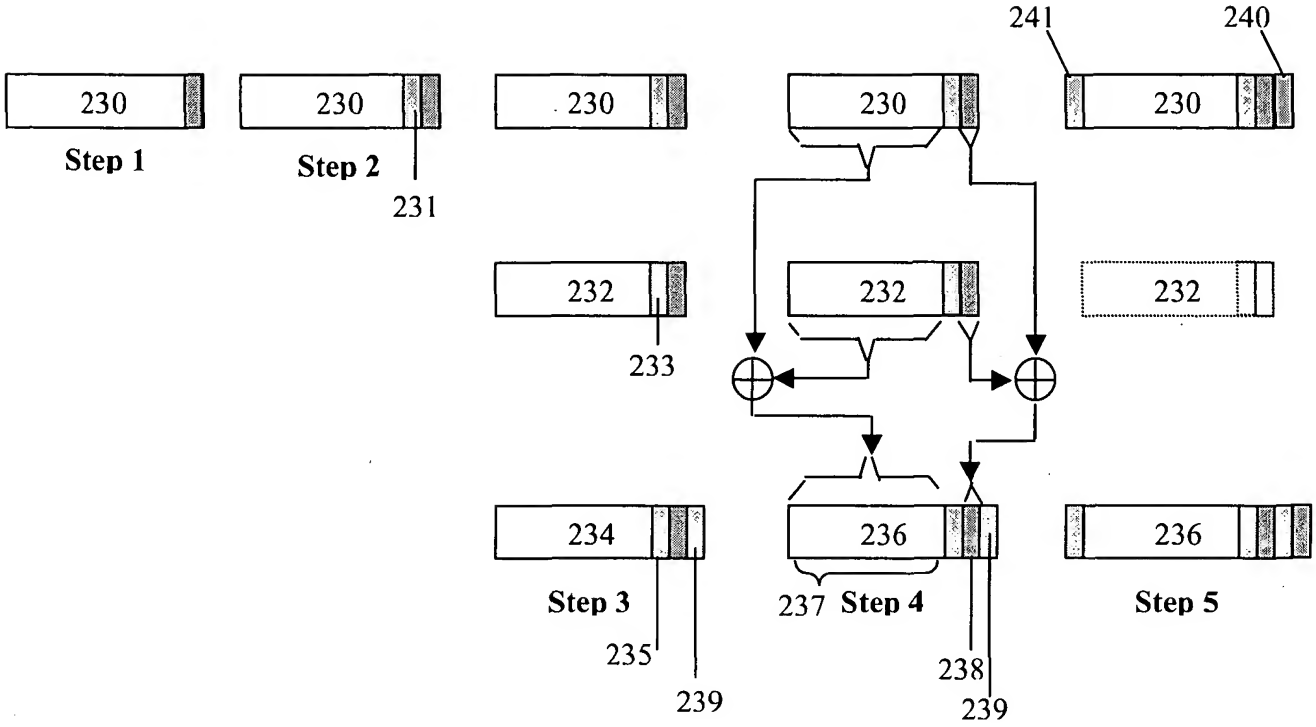

230
Step 1
230
Step 2
231
230
230
241
240
230
232
233
232
232
234
Step 3
235
239
236
237
Step 4
238
239
236
Step 5

FIG 12

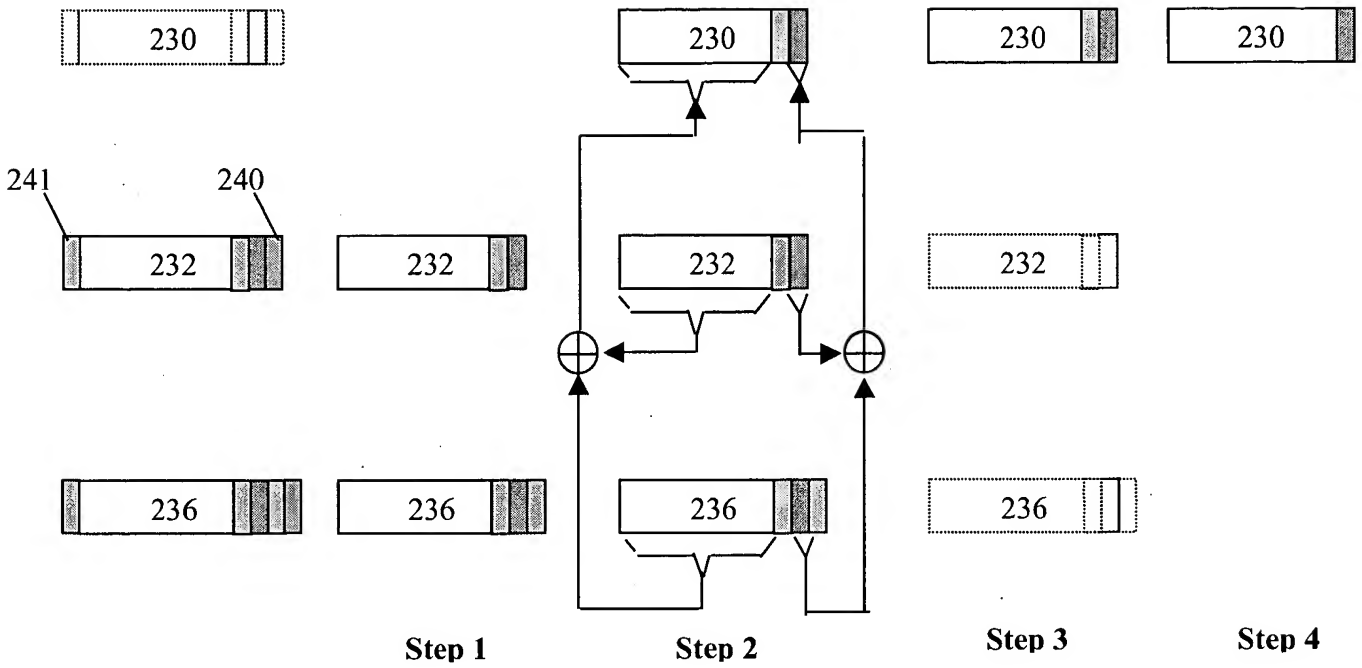

230
230
230
230
241
240
232
232
232
232
236
236
236
236
Step 1
Step 2
Step 3
Step 4

FIG 13

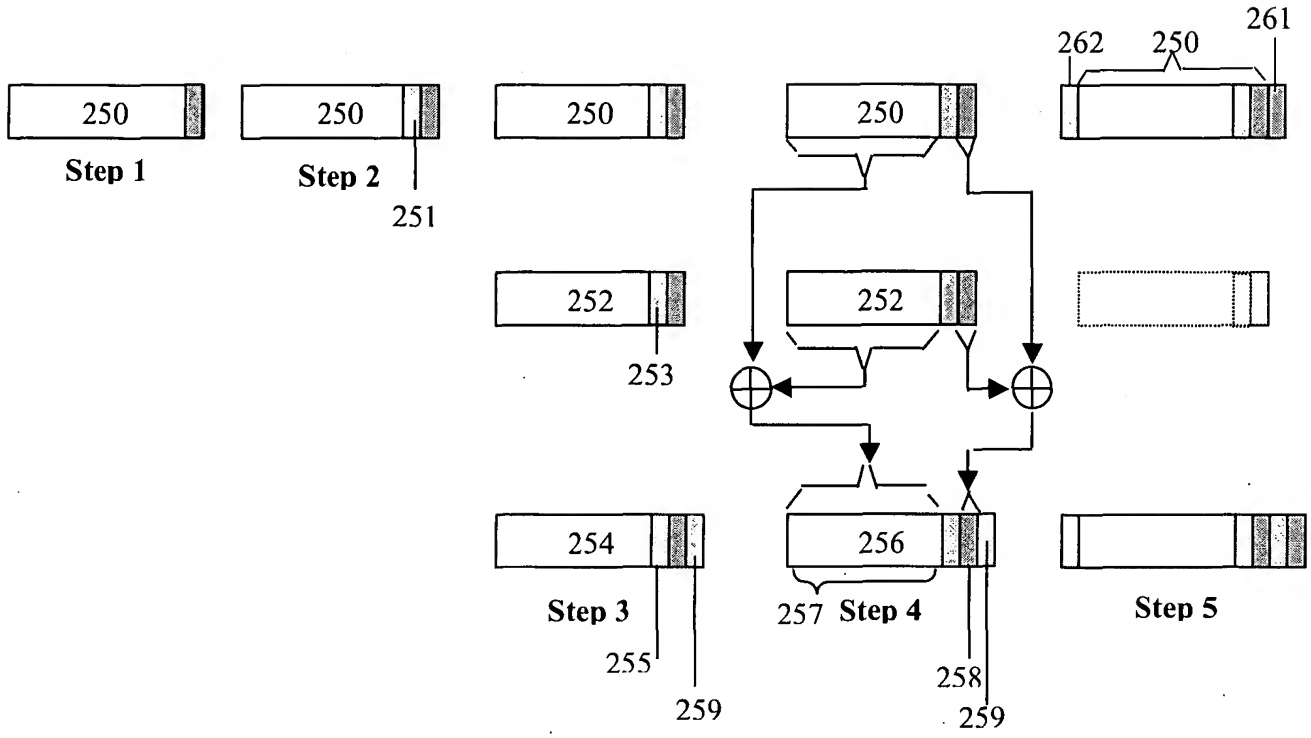

250
Step 1
250
Step 2
251
250
250
262
250
261
252
253
252
254
Step 3
255
259
256
257
Step 4
258
259
Step 5

FIG 14

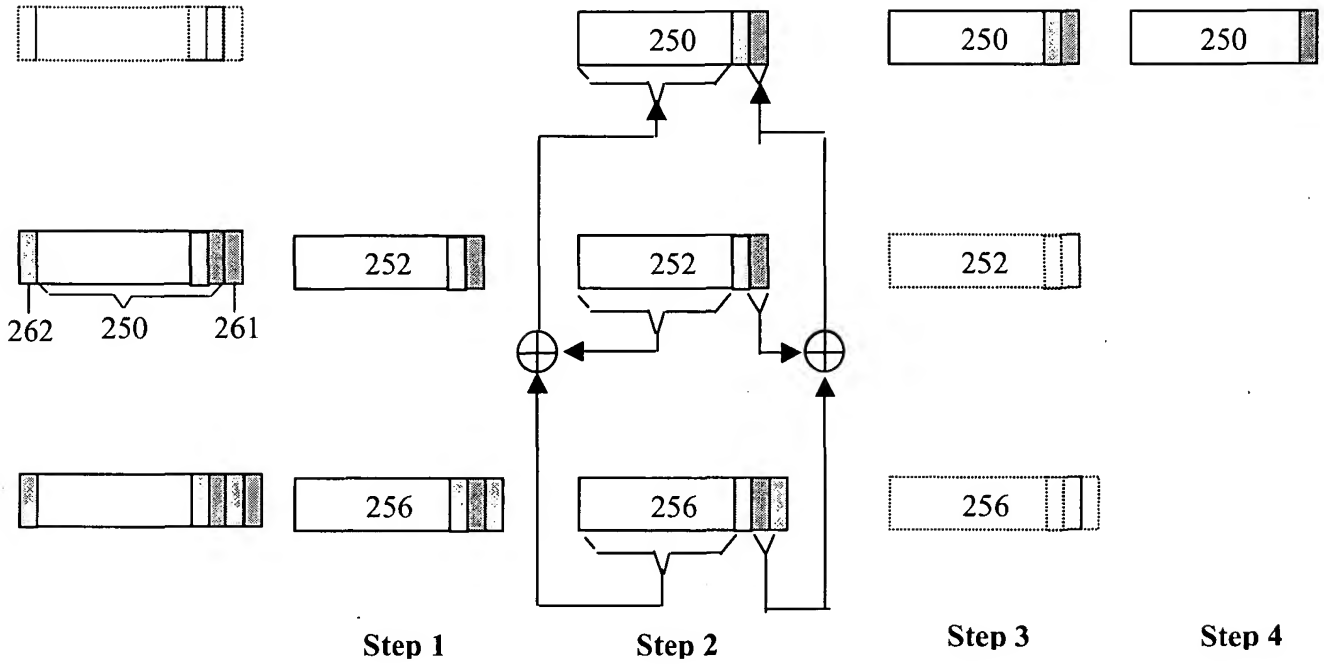

250
250
250
252
252
252
262
250
261
256
256
256
Step 1
Step 2
Step 3
Step 4

FIG 15

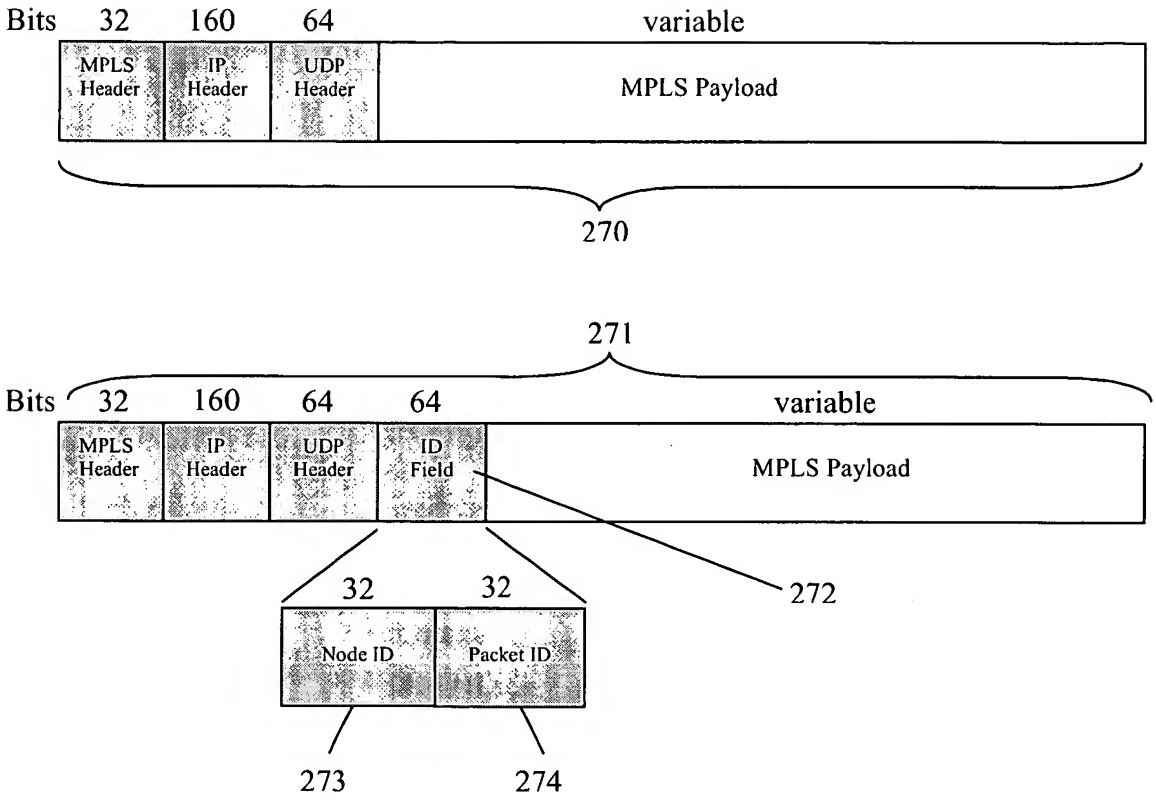

Bits
32
160
64
variable
MPLS Header
IP Header
UDP Header
MPLS Payload
270
271
Bits
32
160
64
64
variable
MPLS Header
IP Header
UDP Header
ID Field
MPLS Payload
272
32
32
Node ID
Packet ID
273
274

FIG 16

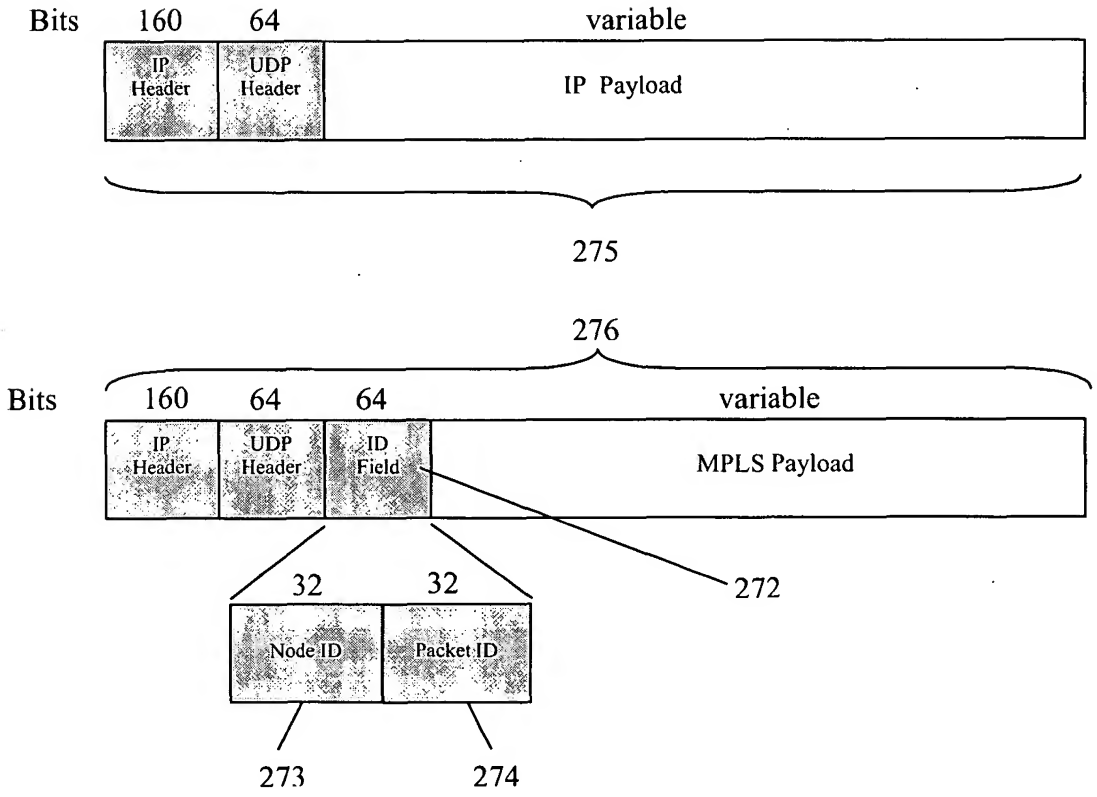

Bits
160
64
variable
IP Header
UDP Header
IP Payload
275
276
Bits
160
64
64
variable
IP Header
UDP Header
ID Field
MPLS Payload
272
32
32
Node ID
Packet ID
273
274

FIG 17

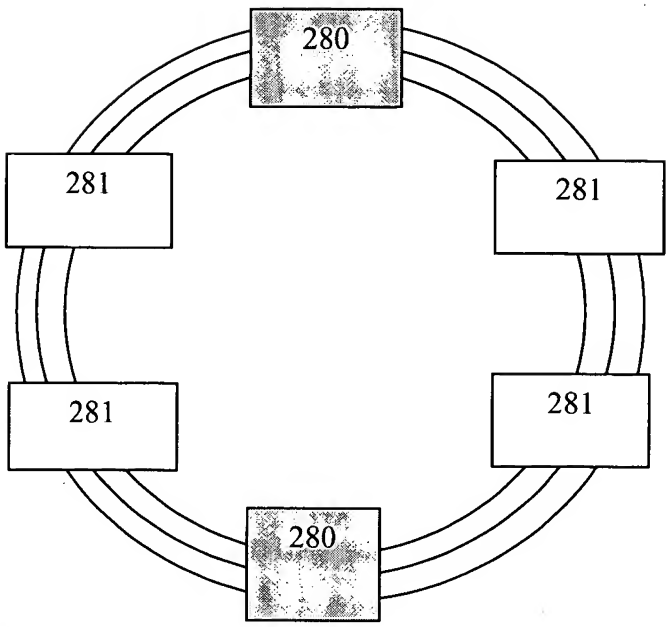


FIG 18

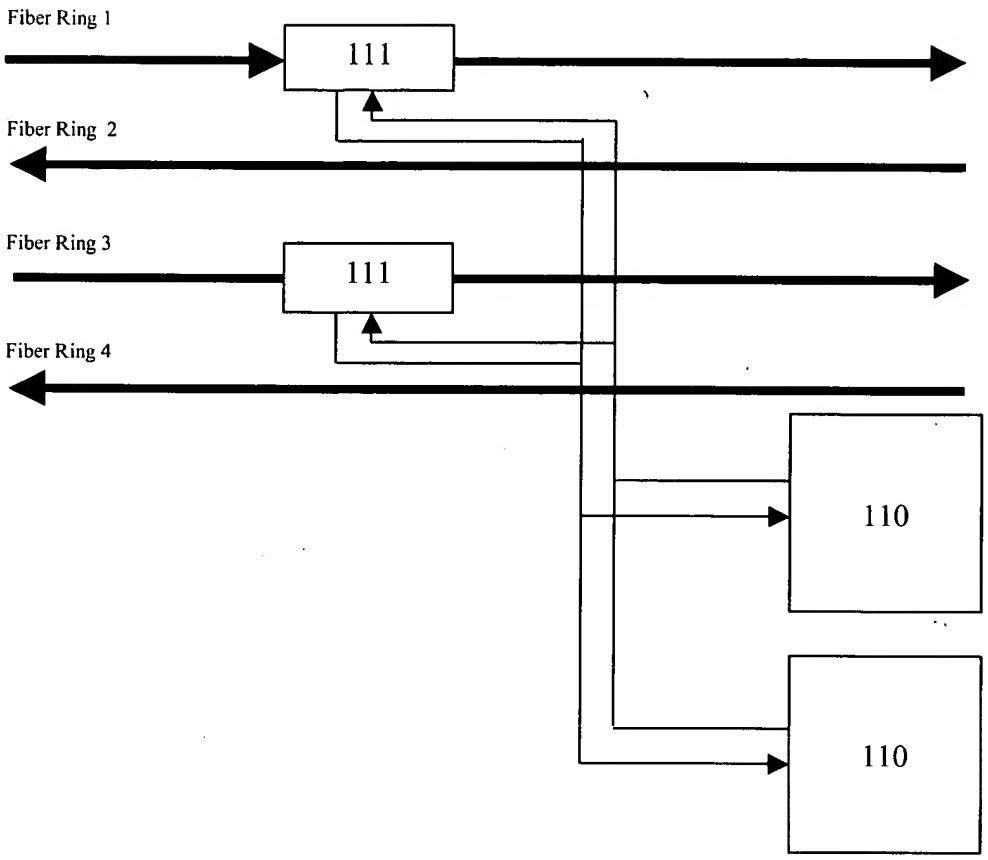

Fiber Ring 1
111
Fiber Ring 2
Fiber Ring 3
111
Fiber Ring 4
110
110

FIG 19

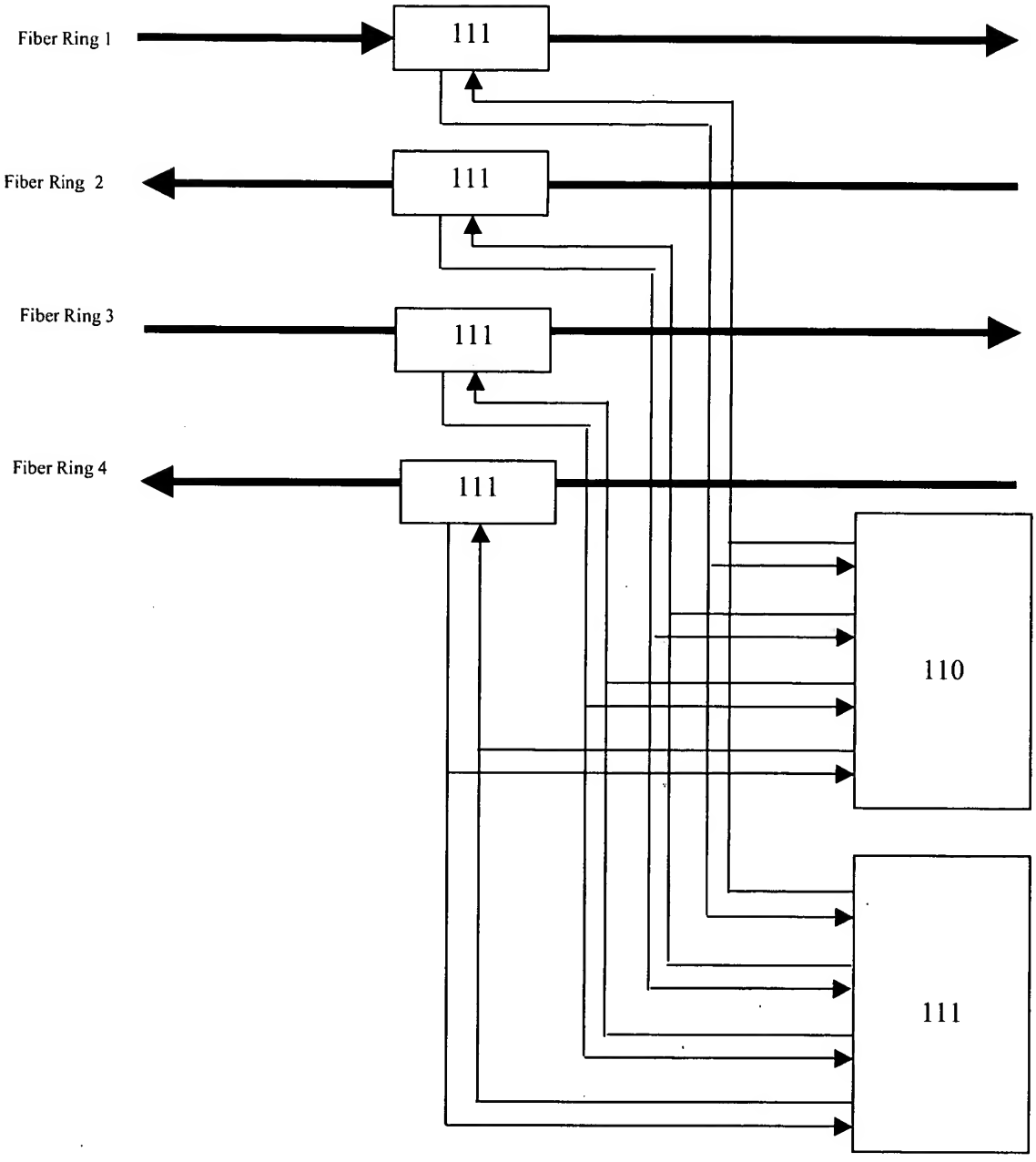

Fiber Ring 1
Fiber Ring 2
Fiber Ring 3
Fiber Ring 4
111
111
111
111
110
111

FIG 20